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ABSTRACT

This compilation represents a jury selection of five papers, which were originally presented at the American Vocational Association Convention in Atlanta, Georgia, that were judged to make a timely contribution to the field of trade and industrial education. Included in the volume are the following papers: "A Status Assessment of Industrial Arts Education in the Public Secondary School of Idaho," by Douglas Hammer; "A Comparison of Selected Student Characteristics and External Influences: Public Community College and Two-Year (Degree Granting) Proprietary Institutions," by William S. Marecki; "Curriculum Model for Electronics Technology," by Jack D. Wamble; "Looking beyond the Mean Score," by Thomas K. Bloom and John Aleong; and "What Research Tells Us about the Preparation of Trade and Industrial Teachers," by Curtis R. Finch and Patrick O'Reilly. (MN)

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THE TRADE AND INDUSTRIAL EDUCATION

RESEARCH COMMITTEE

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FIVE SELECT PAPERS

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Research papers selected from the Trade and Industrial Education Research Committee's carousel presentations, the American Vocational Association Convention, Atlanta, Georgia, December 7, 1985.

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FORWARD

For the past eight years, the Trade and Industrial (T&I) Education Research Committee has hosted a forum for research presentations at the annual conferences of the American Vocational Association. Following juried reviews, successful authors are invited to present their research at a program session sponsored by the T & I Research Committee. This document contains five exemplary papers chosen from T&I research presentations at the American Vocational Association Conference, Atlanta, Georgia, December 6-10, 1986. These papers were selected for a broader dissemination with the intent to make an increased contribution to the profession.

The mission of the Trade & Industrial Research Committee of the American Vocational Association is to promote systematic inquiry, as a means of improving the quality of trade and industrial education programs and services. The Committee accomplishes this mission through the organization of T&I research-related sessions for AVA Annual Conventions, the development and dissemination of timely reports and monographs related to research and development in the T&I area.

Gene L. Roth
Program and Paper Chair
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A STATUS ASSESSMENT OF INDUSTRIAL ARTS EDUCATION IN THE PUBLIC SECONDARY SCHOOLS OF IDAHO

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A STATUS ASSESSMENT OF INDUSTRIAL ARTS EDUCATION
IN THE PUBLIC SECONDARY SCHOOLS OF IDAHO

As we review the technology needs of the country, we find new directions are required for industrial arts education if the discipline is to maintain credibility as a viable curriculum offering. In a study to investigate future employment projections, the National Research Council calls attention to the shift from manufacturing to service jobs. Choate and Epstein (1982) noted that "it is already clear that robotization will do for manufacturing what mechanization did for agriculture, i.e., increase productivity while eliminating millions of existing manufacturing jobs." They further identify the shortage of skilled workers in the technician area. Specifically cited were electronics, data processing and machine repairs. Annison (1983) stated that "the change from the industrial to an information society is not coming. It is not somewhere in the abstract future. It is essentially over and completed in the United States and we are now, in fact, an information service economy." Brookings (1984) provided some additional support to this concept with his statement, "where just yesterday ours was an industrial society, it is now an information society."

With an awareness of the new areas of emphasis for industrial arts education comes a responsibility on the part of all industrial arts personnel. That responsibility is to assist in facilitating the appropriate change. The first step in the development of any change plan is the establishment of a firm information base.

Industrial arts education represents a many faceted curriculum. When further diversified by adding variables such as teacher differences, facility differences, instructional and materials differences, budget differences and various levels of administrative support, it is difficult to accurately maintain a total perspective of the status of industrial arts. For this reason, a current status assessment is necessary. As a state agency concerned with maintaining relevance in the industrial educational program, the intent was to assess that status based upon an acceptable standard and utilizing the results of this assessment to develop appropriate inservice and preservice activities to assist in this process of curriculum change.

If we review history, I am inclined to agree with Dr. Lux (1981) when he indicated that much of the change that has come in industrial arts education has been the result of evolution rather than redirection. The effects of war, the influence of industrialization and the influences of automation have done more to shape industrial arts than have many of the plans and programs that were offered in response to perceived needs in education. Perhaps a primary reason for this is because there was no strong organization devoted to the program, and any positive growth was the result of strong individuals and their respective groups.

The growth of industrial arts in Idaho had, for the most part, paralleled the national norm with some change following some of the national trends, but primary emphasis for this change came from motivation of local instructors and basic state department support.

Basic assessment of industrial arts, both nationally and within Idaho, has been conducted, but the results have been difficult to evaluate. In the recent technical report of the Standards for Industrial Arts developed by Dr. Dugger and associates, the consensus was that there had been no acceptable set of current accurate data existing regarding the number and nature of programs, teachers or students in industrial arts. Probably the most recent compilation of such information had been done by Schmitt and Pelley in their 1963 study. The basic standards project coordinated by Dr. Dugger generated a most comprehensive publication commonly referred to as The Standards for Industrial Arts. The development of these standards provided a complete and validated list of standards for the general industrial arts programs throughout the country. The development process insured a good amount of input from those considered leaders in our field.

Because of the quality of this publication, Idaho decided to utilize these standards and submit them to the instructors for their response indicating, essentially, the status of industrial arts in Idaho. The total instrument appeared to be more comprehensive than necessary and more comprehensive than instructors would take time to complete. For this reason, a panel of experts (leading industrial arts personnel in the state of Idaho) recommended the deletion of a number of the items listed in the standards. The resulting questionnaire addressed all of the ten major topics identified by the Standards. Some of these general topics were further subdivided into a total of 17 categories. All of the industrial arts instructors within the state of

Idaho were invited to respond to the survey. Approximately 59 percent responded with usable returns.

Additional demographic data of the respondents was added to the instrument. This demographic data included the following nine elements:

1. Age.
2. Source and nature of earned degrees.
3. Gross income from teaching industrial arts.
4. Length of teaching contract.
5. Frequency and type of secondary employment.
6. Total years of teaching experience.
7. Total years of industrial arts teaching experience.
8. Certification status.
9. Professional association involvement.

The survey instrument contained 136 research variables designed to collect analytical data in the 17 categories. The subprogram CONDESCRIPTIVE of SPSSX was used to determine the means, standard deviation, skewness and kurtosis for each variable. In addition, subprogram FREQUENCIES of SPSSX was invoked to provide a visual representation of the distribution of responses. Following the individual variable analysis, subprogram RELIABILITY of SPSSX was used to calculate Kendall's coefficient of concordance (W) and the response grand mean for each category of responses. Kendall's W is a coefficient that indicates the strength of agreement in responses to variables constituting a category. The greater the value of the

coefficient (W), the greater the strength of agreement of the respondents. The grand mean was calculated by summing the mean responses to each variable in the category and dividing the resultant sum by the number of variables in the category. The resultant grand mean indicated the strength of agreement, or in one category disagreement, with the construct represented by the variables making up the category.

The study was designed to be descriptive in nature. The results of the study are reported in a manner that allows their use for future theoretical development. Becaue the study was strictly descriptive, theoretical hypotheses were neither developed nor tested.

Cronbaugh's alpha, which is the equivalent of the Kuder-Richardson 20 reliability coefficient for nondichotomous responses, was selected as the most sophisticated method of determining the internal consistency of the instrument. An alpha coefficient was computed for each of the general topic areas of the instrument.

Conclusions

The following conclusions were made by the researcher following a review of the findings of the study.

1. Approximately half of Idaho's industrial arts course content was not compatible with contemporary development in industry, education and curriculum.

2. Professional development activities for industrial arts instructors were not being provided or utilized.

3. Student organizations and local advisory committees were not being organized and utilized by most of Idaho's industrial arts instructors.

4. Student follow-up and program evaluation was inadequate. Formal plans for program improvement were not generally developed.

5. Special populations were not being adequately served by industrial arts programs in Idaho, especially where special considerations were required.

6. Safety instruction and commitment as evidenced by facility appearance and instructor attitude was inadequate in many of Idaho's industrial arts programs.

The following recommendations are the result of the findings of this study.

It was recommended that a statewide comprehensive plan for professional development be created using a committee with representation from industry, industrial arts instructors, industrial arts teacher educators, post secondary vocational education personnel, guidance personnel and the state supervisor for industrial arts education. This committee would organize and provide recommendations for inservice training to provide information and skills to Idaho industrial arts instructors.

Because of the high number of those undecided and the disagreement identified in the study in the following areas, it was recommended that special course work and workshops be planned and utilized to provide assistance and instruction in:

1. Serving the special student in industrial arts.

2. Safety awareness and instruction.

3. Contemporary curriculum accessing and utilization.

4. The role of student organizations as an integral part of the industrial arts program.

5. Establishing and utilizing advisory committees in industrial arts.

6. Student follow-up and program evaluation.

It was recommended that special efforts be directed to assist industrial arts instructors in the areas which received a high level of undecided responses.

It was recommended that similar studies be conducted in other vocational disciplines as appropriate prior to planning for change or inservice activities. This will provide a valid base from which decisions can be made.

It was recommended that additional follow-up research efforts be made that would examine variables that are associated with the difference in level of responses in this study.

While this study was limited to industrial arts instructors in Idaho, implications appear to involve all vocational disciplines that are affected by change.

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A COMPARISON OF SELECTED STUDENT CHARACTERISTICS AND EXTERNAL INFLUENCES: PUBLIC COMMUNITY COLLEGE AND TWO-YEAR (DEGREE GRANTING) PROPRIETARY INSTITUTIONS

William S. Marecki

Running head: Student Characteristics and External Influences

A Comparison of Selected Student Characteristics And External Influences: Public Community College And Two-Year (Degree Granting) Proprietary Institutions

In any study that deals with a comparison of student characteristics and external influences, it becomes apparent that what is really being examined is what the students are like and what may have been some of the variables that have caused them to choose one particular educational system over another.

In a review of the literature, it becomes apparent that many studies fall under the generic categorizations of "student characteristics" and "external influences". However, it is important to note that studies regarding junior colleges/community colleges usually serves specific purposes and tend to be tied to some pressing situation. Thus, they may be examinations of the institution's financial aid program, their specific program packaging, or examinations of a variety of other specific circumstances.

On the other hand, a review of studies dealing with proprietary institutions presents its own limitations. Katz (1973) indicates that the data base for proprietary studies began to develop in the 60's and proceeds from that point. To add to this, a general review elicits

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few studies dealing with degree-granting proprietary institutions and as Simmons (1975) indicates, "There has been little research done on proprietary institutions and even less on those authorized to issue specialized types of Associates Degrees" (p.7). Consequently, the data base for the proprietary sector is at best 20 years old.

Nonetheless, studies can be found that describe students in both sectors by sex, age, race, and a series of other demographic and socioeconomic variables. At the same time, it is possible to find studies that describe various levels of interactions between the proprietary and the community college sector and institutional choice studies that cover the entire spectrum of reasons for choosing one particular institution over another.

This study sampled 337 students enrolled in the degree granting curriculum; business administration and secretarial science at both a two-year degree granting proprietary institution and a community college. The site was Western New York and the urban and suburban campuses of each institution was sampled.

The instrumentation consisted of specific questions from the 1983 Student Information Form with the addition of ten optional questions. The subsequent data was subjected to a series of statistical analysis; specifically, the Condescript of Program. The Statistical Package for the Social Sciences (SPSS), (Nie, Hull, Jenkins, Steinbrenner, Bent, 1975). In addition, the ten optional questions (where appropriate) utilized a Chi Square analysis using the SPSS-CROSSTABS (Nie, et al.,

1975) program.

After the gathering of the data and subsequent analysis, it was divided into eight major categories: demographic, financial information, high school experience, college decision, instiutional choice, self-ratings, possibilities or certain occurrences and ten optional questions. This categorization, coupled with seven central questions that not only examined the significant differences between the two institutions but also examined the campuses in a manner to allow cross comparisons of all four groups: urban proprietary, urban community college, suburban proprietary, and suburban commurity college. This allowed for "between" and "within" comparisons.

General findings of the study indicate that there are, indeed, significant differences between students in both their characteristics and in the external influences (modifiers). If one had to categorize major differences, these differences would be along the lines of ultimate educational and vocational goals, the effects of significant others, and financial aid.

In the comparisons, the two student bodies (as a whole) was found that community college students were effected by parents and significant others; i.e. guidance counselors and former teachers, in the choice process as opposed to the proprietary students who utilize personal visits and conversations with admission counselors to make a specific choice.

There is also the area of ultimate goal. At the .001 level,

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community college students were interested in the transfer aspects of the curriculum while the proprietary students were ultimately interested in a job and at significant levels, indicated that their choice of institution was due to the placement reputation of the institution, the absence of "frills" (liberal arts courses, etc.) and shorter curricular completion time.

Although these variables were significant, perhaps the most telling variable was that of financial aid. As financial aid is associated with family income, the combination actually determines what the real cost of an educational program will be. Thus, the higher tuition of proprietary institution students who came from families with significantly lower income tended to receive greater amounts of grants and aids (free money) and borrowed money to pay for their educational endeavor at significantly higher levels (.001). On the other hand, the community college students (low tuition), did not need to borrow money as the family income and some grants in aid was sufficient to pay the bills.

In general, those categorizations applied to the students at either the proprietary or community college. However, in an examination of the institutions in the "between" and "within" process, it was found that within each institution, there was a distinct suburban and urban group, and they tended to be similar to their corresponding group. Thus, the proprietary suburban students tended to resemble the suburban community college students, etc. However, it is not to say that they

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are interchangeable, but, it does seem to follow Sewell, Haller, and Portes (1969) position that students tend to fall in line with their normative reference groups.

Finally, it is virtually impossible to indicate a number of variables and state that this is why one person chooses one institution over another. The multiplicity of variables in the choice process would preclude anything as simple. It is, in fact, this multiplicity and the interaction that makes the entire process both arduous and fascinating.

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Curriculum Model For Electronics Technology

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Presented to the

American Vocational Association Convention

Atlanta, Georgia

July 1985

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CURRICULUM MODEL FOR ELECTRONICS TECHNOLOGY

Electronics is a rapidly growing technology. Microstructure, Science, Engineering, and Technology (1979), prepared by a committee of the National Academy of Sciences, stated that the "modern era of electronics has ushered in a second industrial revolution--its impact could be greater than that of the original industrial revolution." (p. 43) During the next decade or so, much of the growth in electronics will come as the technologies of computers and communications are joined (Larky, 1984). This combination will lead to the development of many new systems, new businesses, and new opportunities in electronics.

The most obvious impact of high technology on T & I education will be to develop new programs required to prepare people for high technology occupations that previously did not exist. Goetsch (1984) stated that the high technology revolution presents a challenge that neither education nor industry can solve alone. Industry-education cooperation, which has always been desirable, is now essential. Close cooperation between education and industry will be necessary if T & I education programs are to meet the challenge of high technology.

Curriculum Project: Education and Industry

This educator had an opportunity to work closely with 30 selected representatives from education and industry on

a curriculum project to develop a Bachelor of Science degree in Electronics Technology. The Regents College Program of the University of the State of New York proposed to bring together existing resources of industry and education to develop non-residential baccalaureate degree options in two technical disciplines: Electronics technology and computer technology. The Bachelor of Science Electronics Technology degree will be presented for discussion in this paper.

The research method used in this project is generally referred to as descriptive. According to Best (1970, p. 116), descriptive research:

> ". . . describes and interprets what is. It is concerned with conditions or relationships that exist, practices that prevail, beliefs, point of view, or attitudes that are held; processes that are going on; efforts that are being felt; or trends that are developing."

The purpose of any research and development is to develop a product, such as a new curriculum, test or publication (Bailey, 1978).

Degree Structure

Preparing students to cope with our present and future technological society demands that students be equipped with more than basic skills. Future workers at all levels will need a broad understanding of the entire system. The committee decided that to prepare people for a wide range

of jobs in industry, the degree should be flexible rather than following a prescribed track of study.

The Bachelor of Science Electronics Technology degree was designed around three components of study and requires a minimum of 124 semester hours credit. The three components of study are: (1) a general education component, (2) an electronics technology component; and, (3) an elective component.

Requirements for the Degree

1. Arts and Science Components (60 Semester Hours)
   A. Humanities and Social Sciences: Of the 60 credits required, a minimum of 24 must be in the humanities and social sciences. These credits must be distributed in the following manner:
      1. Humanities: A minimum of 9 credits must be earned in such subjects as English, languages, art, music, philosophy, etc.
      2. Social Sciences/History: A minimum of 6 credits must be earned in such subjects as sociology, economics, history, psychology, anthropology, etc.
   B. Natural Sciences/Mathematics: Of the 60 credits required, a minimum of 24 credits

must be in natural sciences/mathematics and must include:

1. Calculus or Applied Calculus I and II
2. Physics I and II (minimum of one lab)

Courses in Chemistry and Differential Equations are highly recommended as additional natural sciences/mathematics background.

C. Arts and Science Electives: The remaining 12 credits to complete the 60 semester credit requirement may be earned in any arts and sciences subjects.

2. Electronics Technology Component

A. Electronics Technology Core Requirements: Students must complete a minimum of one course in each of the following subjects:

Circuit Theory I (with lab)
Circuit Theory II (with lab)
Electronics I (with lab)
Electronics II (with lab)
Digital Electronics (with lab)
Microprocessors (with lab)
Electronic Communications (with lab)
Systems
Computer Programming

B. Electronics Technology Electives: Electives selected from the electronics technology elective list (Appendix A) may be used to complete the 48 credit requirement.

3. Free Electives: Any college-level credit may be applied as free electives. (College Regents, 1985)

The technical base for the degree was built on four principles:

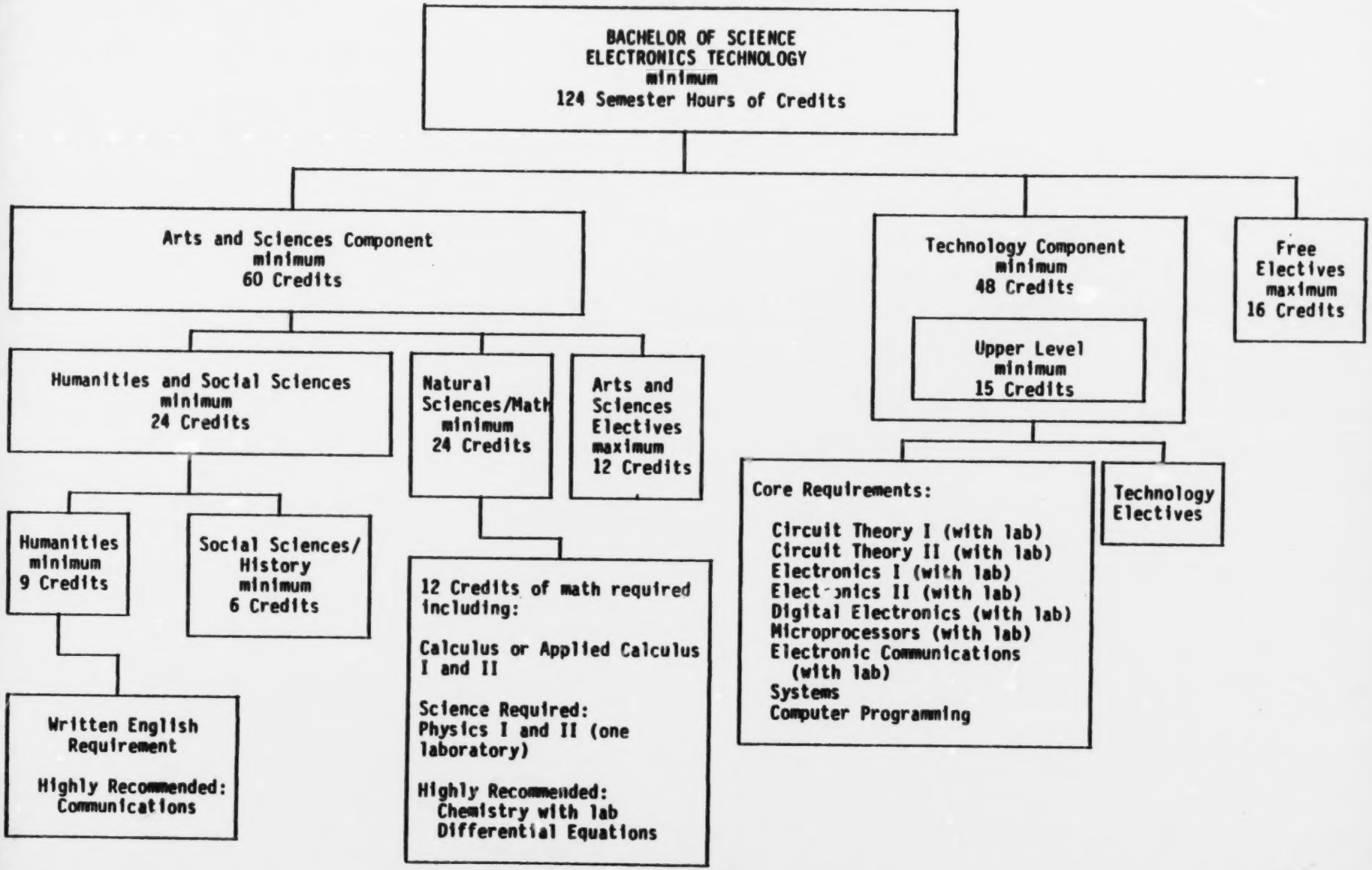
1. A broad knowledge base that includes applied calculus, applied physics, chemistry, computer programming, electronics, electricity, fluid power, and mechanics.
2. Industry is system oriented. High technology occupations involve complex systems composed of electrical, electronics, mechanical, pneumatics, hydraulics, thermal, and optical devices.
3. An indepth understanding of the underlying principles. High technology workers must apply theories and principles in devising original solutions to problems.
4. Curricula offerings should reflect alternative paths for training. The high technology worker's job description is subject to rapid and continuous change.

Education and industry, each learning from the other and each making appropriate contributions, completed the curriculum project in one year. Table 1 presents the Bachelor of Science degree in Electronics Technology in outline form.

Insert Table 1 about here

It is essential that T & I education programs keep abreast of changing requirements of industry if program completers are to be productive members of the work force. Close cooperation between education and industry will be necessary if T & I education programs are to keep pace with advancing technology.

TABLE 1



From Bachelor of Science Electronics Technology. Regents College Degree Program and the University of the State of New York, 1985.

APPENDIX A

Electronics Technology Degree Electives

The following is a listing of electronics technology degree electives that are currently accepted toward the technology component. They are placed in two categories. A student may select either, all, or a majority of his electives from the electronics elective list. The computer listing is for those students who choose to supplement their electronics technology background with computer technology course work; a student may not include more than 2 courses from the computer listing in fulfilling the requirements of the technology component.

ELECTRONICS

Advanced Communications
Advanced Electronics
Antennas
Control Systems
Digital Process Control
Electrical Machines
Electro-Optics
Electro-Optics Measurements
Fiber Optics
Industrial Power
Instrumentation
Lasers
Laser Applications
Light Sources & Wave Optics
Microelectronics
Microwave Communication
Microwave Devices
Network Analysis
Power Generation
Satellite Communication
Transmission and Distribution Systems
Video Systems

COMPUTERS

Advanced Digital
CAD/CAM
Computer Graphics
Computer Systems
Computer Languages
Data Communication
Robotics (Computer Based)
Statistical Quality Control

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LOOKING BEYOND THE MEAN SCORE

by

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Presented at

American Vocational Association Convention

Trade and Industrial Research Committee

Atlanta, Georgia

December 7, 1985

LOOKING BEYOND THE MEAN SCORE

Several times a year in the vocational education journals, articles are published that use item means on a questionnaire as a method of ranking or rating several elements of a popular concept. Typically, opinions or attitudes of a particular population towards the concept are assessed. While this method is useful and widely used in educational circles, we need to be reminded of obvious short comings of using this approach.

By definition, all descriptive statistical methods are used in order to simplify or summarize large bodies of information. This allows the observer to examine complex bodies of information much faster and more efficiently. Recognizing this, we must be aware that simplification of information sometimes distorts the meaning.

For discussion purposes we present the following example. Let us assume we are determining school administration attitudes towards vocational education. The goal of our research is to seek to rank these attitudes by level of agreement across respondents as well as compare these attitudes by level of administration. We present a 30 item questionnaire with a Likert type scale to measure response to statements on a 1 to 5 scale. let us assume we received 300 usable questionnaires from our sample.

Typically, the first step in the analysis is to determine the mean score for each item on the questionnaire. Next, items are presented in a ranking scheme by the mean score. The example of Table 1 demonstrates this approach that is commonly reported in the vocational literature.

Table 1 - Attitudes of School Administrators Towards Vocational Educators (Hypothetical)

ITEM NUMBER	ITEM	MEAN RESPONSE
4	Low Academic achievers have a tendency to enroll in this vocational area.	3.0
22	Adequate vocational counseling is available from guidance counselors.	3.0
23	Class scheduling is usually not a problem for those students wanting vocational training.	3.0

The problem with this approach is twofold. First, it radically distorts the true responses received from the sample. Secondly, the results are very dependent on the particular system of numbers used.

Let us present another method. Rather than presenting mean responses, we recommend presenting a full frequency tally and percentage for each response. Table 2 presents our expanded display of the response data.

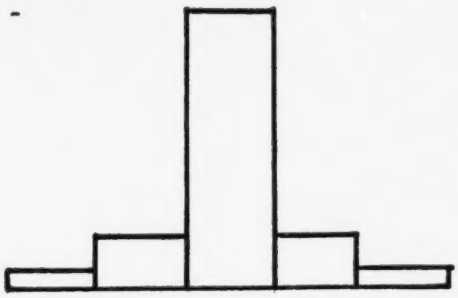
Table 2. Attitudes of School Administration Towards Vocational Education (Hypothetical)

ITEM NUMBER	ITEM		1	2	3	4	5	MEAN SCORE
4	Low academic achievers have a tendency to enroll is this vocational area.	n	10	30	220	30	10	3.0
		%	3	10.0	73.3	10.0	3	
22	Adequate vocational counseling is available from guidance counselors.	n	60	60	60	60	60	3.0
		%	20	20	20	20	20	
23	Class scheduling is usually not a problem for those students wanting vocational training.	n	140	7	6	7	140	3.0
		%	46.6	2.3	2	2.3	46.6	

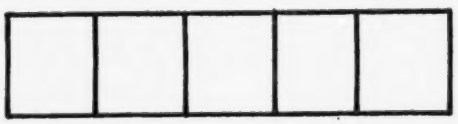
To elaborate on Table 2, the response on item 4 shows the vast majority of administrators were neutral of the achievement level and enrollment issue, with nearly 75% marking this response. Item 22, with the same mean score, shows a very different response, with 20% of the administrators selecting each of the 5 alternatives. On item 23, dealing with scheduling, an extremely polarized situation is reported, whereby nearly 50% of the respondents either "strongly agreed" or "strongly disagreed" with the item. Again, the mean reported response was 3.0. These three examples vividly demonstrate the oversimplification that is possible when just item mean scores are reported.

Diagramatically, the categorical distribution of responses would appear as follows:

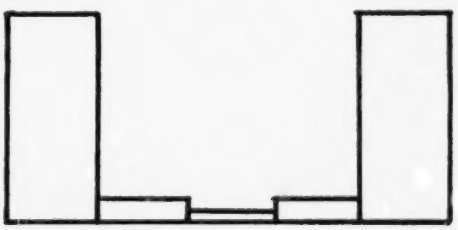
Item 4



Item 22



Item 23



The approach in Table 2 allows an investigator a method of portraying categorical responses in a much more accurate manner than in Table 1.

The next problem becomes how can categorical data be analyzed to look for differences across respondents. Three methods will be briefly discussed that provide some direction.

Chi square tests

The chi square test is one of the more popular methods. This method is an expansion of Table 2, whereby a percentage response for each category within an item is tested for equality.

Item 4

	SUPERINTENDENTS	SUPERVISORS	PRINCIPALS	
Strongly agree	0	10	0	10
Agree	0	30	0	30
Neutral	80	60	80	200
Disagree	15	0	15	30
Strongly disagree	5	0	5	10
	100	100	100	

If there were no difference across levels of administration, we would expect equal percentages of responses within each cell. In this example it is not the case with supervisors exhibited different responses than the other administrators.

Ridit Method

The ridit method assigns empirical probabilities according to the relative frequency of values in each ordered category. (Selvin - 1977, Kantor et al - 1968, Fleiss - 1981.)

In ridit analysis we need a population to serve as a reference or standard group. Note that ridit comes from the initials "relative to an identified distribution". From Table 3 for item 4, the ridit for the category undecided is .4 which is equal to the proportion of all subjects from the reference group subjects falling in the lower ranking categories (i.e., strongly disagree, agree), plus half the proportion falling in the undecided category. Here, for illustration, we are using the Superintendents as our reference group. Now for the Supervisors we can compute the mean ridit. The mean ridit for supervisors is the sum of the products of the observed frequencies of supervisors multiplied by the ridits for the reference group (i.e., superintendents), divided by the total frequency. The computations are given in Table 4. The mean ridit for supervisors is .24. Thus the odds are 1 to 3 (.24/.72) that a supervisor will be in more agreement than a superintendent in this study.

Table 3.

Item 4 (Superintendents)

Calculation of Ridits

Responses	1	2	3	4	Ridit
Strongly Disagree	0	0	0	0	0
Disagree	0	0	0	0	0
Undecided	80	40	0	40	.40
Agree	15	7.5	80	87.5	.875
Strongly Agree	5	2.5	95	97.5	.975
Totals	100				

Instructions

Column (1): The frequency distribution

Column (2): One-half of the corresponding entries in Column (1).

Column (3): Accumulated entries in Column (1), but displaced one category downwards.

Column (4): Column (2) plus Column (3).

Column (5): Column (4) divided by the total sample size (100). The numbers are the ridits.

Table 4

Response	Supervisors Count	Ridit from Reference Group	Product
1	10	0	0
2	30	0	0
3	60	.4	24
4	0	.875	0
5	0	.975	0
			24

$\bar{r}$ $0 = \frac{24}{100} = .24$

Standardized Relative Entropy Measure

This measure is used to assign a value on the structure of responses from a group. The group may hold a perfect consensus to complete dissension, or somewhere in between. An entropy measure in the sum of the probabilities of a particular response category i, multiplied by the log of the probability pi where: $\sum pi \times 1\ n\ (pi)$.

If there is a high p, there is little structure to the responses or the responses are "entrophic." If there is a low p, or close to a zero p, the responses show much more consensus. (Frey - 1984.)

The value of this measure for researchers is that if the analysis exhibits a low p, it would be redundant to sample a large group since their views would be similar. While a high p would mean a much larger sample would be needed, since their view would be more diverse.

Summary

In this short talk we have attempted to identify several problems in using mean scores on categorical data as method to ranking opinions or attitudes. We strongly suggested presenting complete tallies with percentage scores so the reader can examine the subtlety of the responses that are not ordinarily available in current research reporting.

Also, we suggested looking at three methods to analyze categorical data that are presently not used to full advantage in most vocational education research activities. We recognized that in this short discussion we could not present a comprehensive view of these methods. However, we hope the time we spent will encourage you to read the paper and seek more complete understanding in order to enhance the level of research in vocational education.

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WHAT RESEARCH TELLS US ABOUT THE PREPARATION OF TRADE AND INDUSTRIAL TEACHERS

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WHAT RESEARCH TELLS US ABOUT THE PREPARATION OF TRADE AND INDUSTRIAL TEACHERS[1]

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Problem

Although numerous research studies have focused on various aspects of trade and industrial (T&I) teacher education, little is known about the collective impact these studies may have. In fact, the field is virtually devoid of syntheses focusing on T&I teacher education research. Two exceptions are reviews conducted by Bjorkquist and others (1968) and O'Brian and Schaefer (1968). These documents, while most significant for their time, are currently almost eighteen years old and as such do not reflect the current state of the scene.

This study has as its objective the synthesis of T&I teacher education research conducted over the past eighteen years with particular emphasis on the last decade. Questions for which answers were sought included:

1. In what areas does T&I teacher education research appear to be most prevalent?
2. What implications for T&I teacher preparation may be drawn from the research conducted?

Method

The identification of relevant research included both manual and computer-based searches. Computerized data bases explored included the Education Resources Information Center (ERIC) and the National Technical

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[1] Portions of this paper have been drawn from a comprehensive synthesis of research in the T&I field (Finch, 1983).

Information Service (NTIS). Professional journals related to the field were, likewise, examined in an effort to locate relevant studies. Dissertation Abstracts International served as a prime source for relevant doctoral dissertations. Selected T&I teacher education programs across the nation were contacted in an effort to identify more recently completed research studies that might not yet be listed in data bases. Studies were screened and, if selected, included in one of several broad research categories. Various studies were then summarized and synthesized by category.

It should be noted that this synthesis is, for the most part, selective in nature, drawing from exemplary and representative studies in the field. No attempt has been made to list each study conducted over the past eighteen, ten, or even five years.

T&I Teacher Education

T&I teacher education has been a research mainstay for many years. Even a cursory view of the literature reveals that numerous T&I teacher education research studies have been conducted. There may be plausible reasons for this phenomenon. First, many doctoral advisors are themselves T&I teacher educators who have a continuing interest in the area. Second, many doctoral students aspire to become T&I teacher educators. Their research studies may reflect an actualization of aspirations and interests. Regardless of the reasons, however, there is no lack of studies in the T&I teacher education field.

Those seeking to gain a historical perspective on this research area are urged to examine several reviews conducted over the past two decades. A review of research in vocational-technical teacher education conducted by Moss (1967) dealt with the period from 1962 to 1967. The review in-

cludes a classification model that may be useful to persons interested in organizing studies and exploring the interrelationships among them. In a more specific context, O'Brian and Schaefer (1968) provided a comprehensive review of T&I teacher education research through 1967. They commented at that time about little having "been done over the past decade to take a hard look at T&I teacher education" (p. 44). The authors recommend more targeted, sophisticated studies in this area. Bjorkquist and others (1968) provided similar observations, indicating that "research in T&I teacher education is still in an embryonic state" (p. 12). They also provided, as a vehicle for improvement, a research framework that takes a more comprehensive view of T&I teacher education research.

Several other documents should also be noted. Vocational teacher education research reviews conducted by Peterson (1973) and Adamsky and Cotrell (1979) include a number of T&I-related citations. These may be examined by persons who want to view T&I teacher education research within the context of vocational teacher education.

The remainder of this paper focuses on several areas associated with T&I teacher education where research efforts have seemed to cluster. These include supply and demand, teacher characteristics, program development, teacher behavior, and professional development.

Supply and Demand

Recruitment and retention of qualified teachers has plagued T&I teacher education for many years. Since T&I teachers typically have many years of successful work experience in industry, they must sometimes be lured into teaching and often take a sizable salary cut in the process. Once the teacher is employed there is always the problem of retention

since individuals may easily move back to their former work fields if they become disenchanted with the teaching field.

A study conducted in Indiana by Wittkamper (1984) examined various factors influencing tradesmen to become secondary vocational education teachers. Results revealed that there was no one influencing factor that led to the decision to make a midlife career change. The desire for change was not as much dissatisfaction with previous work experience as it was a personal need or challenge for increased responsibility or personal growth and development. Reasons for becoming teachers appeared to parallel Maslow's and Herzberg's hierarchy of needs. Of course, once persons enter the profession, they must have some reason to remain as teachers. Bloemker (1983) explored this important area, drawing from a population of industrial education teachers in Illinois. Data gathered using a Retention Factor Questionnaire were analyzed via principal components factor analysis and varimax rotation. The research indicated that factors associated with a decision to remain in the teaching profession were school and community service, physical facilities and equipment, program development/instruction, daily academic services, professional development, professional contributions, and teaching salary.

In the area of teacher attrition, Lindsey (1979) examined the turnover of T&I teachers in an attempt to identify why the turnover rate was so high. It was determined that inadequate salary was the primary reason given by those leaving teaching positions in Texas secondary education programs. Lindsey also noted that a significant difference existed in the salary paid those who continued to teach and those who left teaching for other positions. A related study by Brockway (1980) focused on factors related to the newly employed, nonprofessionally trained teacher's decision

to leave the profession. Those who left teaching did so because of poor student attitudes and because teaching took more time than they were willing to commit. Those who remained in teaching did so because they enjoyed helping students learn and sharing their experiences with them.

As one strategy to deal with teaching shortages in T&I programs, Cap (1980) explored the use of retired crafts workers as volunteer aides in Ohio high schools. The study revealed that the actual pool of available volunteers from retired crafts workers may be rather small, due to lack of interest or health problems. The teachers and the retirees saw volunteer use in different ways. Teachers felt volunteers would be most helpful in supportive areas such as guidance and public relations, whereas, retirees believed they could provide the greatest assistance in actual instruction.

Thomas and Boyett (1976) provided insight into the ebb and flow of teachers in Florida by developing a statewide supply and demand model for vocational teacher education. Results indicated that, with one exception, supply and demand were fairly well balanced. The current number of graduates from teacher education institutions was not found to result in an oversupply of teachers. Although these data may have changed over the years, a comprehensive approach to teacher supply and demand appears sound. States and perhaps regions should consider such a strategy since it can be a useful aid to program planning processes.

Teacher Characteristics

Several reports have been made over the years about how T&I teachers differ from their academic counterparts. Others have highlighted the personal characteristics of T&I teachers (e.g., Finch 1969). More recently, however, researchers have begun to explore how the T&I teacher views a

range of teacher-related areas such as job satisfaction. Others have explored relationships between teacher characteristics and student achievement.

Stewart (1984) investigated the relationships between job satisfactoriness, occupational competency, occupational cluster, age, education level and years of occupational experience. No relationship was found between job satisfactoriness and occupational competency or between overall job satisfaction and overall job satisfactoriness, occupational competency or occupational cluster. However, job satisfaction was found to be predictable using the conformance subtest of the Minnesota Satisfactoriness Scale. Job satisfactoriness was predictable using a combination of occupational competency measures and job satisfaction scores.

Garcia (1980) explored the relationship of job satisfaction and selected demographic variables with vocational teachers' desires to change careers. A subset of these teachers represented the T&I area. Although linked in many respects to studies in the previous section, this investigation included collection of extensive job satisfaction and career change information from respondents. Results indicated that barriers influencing teachers' desires to change careers include a lack of financial security, a lack of demographic mobility, and a feeling of uncertainty about other careers. Important reasons behind the desire to change careers were a desire for higher salary, need for greater achievement, and concern about student quality.

The areas of job stress and burnout have received wide attention in recent years. Teacher burnout has been a particularly popular topic in both the professional and popular literature. Lentz (1983) studied occupational sources of stress and the relationship to the personal and per-

sonality characteristics of secondary vocational educators. Results indicate that T&I teachers feel less stress from time pressure than their colleagues and that teachers with less than a bachelor's degree feel less stress from professional problems, time pressures, and classroom structure sources than do degreed teachers. Overall, teachers with lower tolerances of ambiguity and self-acceptance were found to feel higher levels of stress related to classroom structure, pupil misbehavior, and poor pupils. Teachers with Type A personality characteristics were found to suffer higher levels of stress related to the professional problems and time pressures of teaching than did those with Type B personality characteristics.

Conflict between actual and anticipated teaching roles can be a major source of stress. The comparisons of actual and anticipated roles of T&I teachers was made by Bach (1974). The Delphi technique was used to seek consensus of perceptions about teacher roles from teachers, colleagues, and students. An analysis of the percentages of consensus indicated the following:

> All groups had consistently larger percentages of consensus for the behaviors which they thought the trade teacher should actually perform. This was even true of the trade teacher's own perceptions. (p. 43)

Thus, each respondent group perceived what the T&I teacher was doing as being significantly different from what ought to be done.

In a similar vein, Means (1982) compared the teacher role perceptions of non-degreed vocational teachers with those of degreed non-vocational teachers prior to their actually having taught and after one semester of teaching experience. While pre-service differences were found between

degreed and non-degreed teachers, comparisons between males and females both within and across groups showed no significant differences in role perceptions. Following one semester of teaching experience, differential changes in role perceptions were found to be associated with the interaction of gender and educational status.

Teachers' attitudes toward and perceptions of students have also been a research focus. Bradley and DuCette (1976) sought to compare perceptions of T&I teachers and general education teachers in terms of the ideal child and the successful student. Participants included 104 T&I teachers and 138 teachers of general education subjects. In the case of both groups, perceived attributes that are most important to the ideal child were noted as being the same as those most important for the successful child. There was, however, no agreement between teacher groups on the perceived importance of specific attributes. T&I teachers characterized the ideal student as being cooperative, honest, ambitious, competitive, and obedient, whereas general education teachers characterized the ideal student as being curious/inquisitive, open-minded, a critical thinker, honest, and independent.

Post-secondary T&I teacher's attitudes toward handicapped students and the relationship between personal characteristics of those teachers and their attitudes towards handicapped students were investigated by Claxton (1984). Overall, post-secondary T&I teachers were found to be accepting of handicapped students. A relationship was found between gender and attitude; however, age, race, educational level, and years of teaching experience were not found to be related to teachers' attitudes toward handicapped students. The relationship between variables describing teachers' experience with handicapped students and their atti-

tudes toward those students was mixed. Variables which would indicate actual involvement with handicaped students at the time the study was conducted significantly affected teachers' attitudes while variables indicating past experience with handicapped students and involvement in preparing to teach handicapped students were not related to teachers' attitudes. Excluding gender, personal concurrent contact with handicapped students was related to attitudes toward those students while experience and preparation were not.

Attitudes toward individualized instruction were the focus of a study by Friedman (1983). While vocational teachers as a group were found to have an overall positive attitude toward the philosophical and theoretical constructs of individualized instruction, technical and T&I teachers were most positive and, in fact, implemented individualized instruction most often. Two other factors were found to foster both a positive attitude toward, and use of, individualized instruction. The more business/industrial experience a teacher had, the more likely he or she was to have a positive attitude toward, and use of, individualized instruction. Also, a positive attitude toward, and use of, individualized instruction was more likely to exist among those who had taken a college level course on the subject than among those whose knowledge had come from either local or state staff development activities.

As a group, T&I teachers have generally been characterized as being very conservative in their attitudes, whether the area is students, instruction, curriculum, or other aspects of education. Research into specific questions of conservatism has not supported this widely believed myth. Oscarson (1977) found that the adoption-proneness of T&I teachers was related to specific characteristics such as age, reading habits, sat-

isfaction with teaching, and length of tenure in the school district. As a result, two distinct groups could be identified. Younger, more widely read, and more satisfied T&I teachers were more receptive to change than were their older, less widely read counterparts with more teaching experience. Thus, research appears to indicate that T&I teachers may be less conservative in their attitudes than other vocational teachers on many issues. However, a subgroup of T&I teachers that could be labeled as not receptive to change does exist.

Several researchers have chosen to focus on the occupational competence of T&I teachers. Since most T&I teachers must successfully complete occupational competency examinations before they are fully certified, questions are often raised about how these scores related to other areas. Whitener (1981) explored the relationship between National Occupational Competency Testing Institute (NOCTI) examination scores and occupational experience, teaching experience, and educational level. Four T&I areas were chosen for examination: auto mechanics, carpentry, machine trades, and quantity food preparation. Since relationships varied from one occupational area to another, it was recommended that minimum requirements for the selection and certification of T&I teachers may need to vary for each occupation to reflect optimum occupation competence. A similar study by Abrams (1981) focused on data from 154 Kentucky T&I teachers. NOCTI data were correlated with a host of personal characteristics variables. No relationships were found between NOCTI examination scores and education, work experience, number of places worked, teaching experience, and level of teaching. Similar results were found by Schenck (1979) when the occupational competence of T&I teacher education students was compared across three work experience combinations. However, Hux (1980) refuted

Schenck's results, citing methodological weaknesses that may have affected results.

The questions of how much and what types of work experience are needed to assure competence of a T&I teacher have remained unanswered since 1917. Many researchers have attempted to answer these questions from a variety of perspectives with mixed findings. Kim (1979) investigated the relationship of the amount and pattern of work experience and teacher competency using a sample of T&I teachers from Ohio. More work experience, work experience in a variety of settings, and broader work experience background were found to be negatively related to overall teaching competency, as indicated by supervisor ratings. In addition, they were negatively related to rated competence in terms of broad areas categorized as "Personality and Attitude", "Guidance and Counseling" and "Purpose and Objectives". Thus the question of whether work experience or pedagogy is more important remains unanswered.

Several researchers have begun to explore relationships between teacher characteristics and student achievement. Pantalone (1979) analyzed relationships between T&I teachers' backgrounds and graduating students' gainful employment rate. Extensive work experience or employer contacts made by teachers did not relate to student employment rate. The amount of teaching experience and teacher education level was likewise unrelated to student employment rate. Relationships between T&I teachers' personal characteristics and student achievement as measured by the Ohio Vocational Education Achievement Test Program were examined by Brannam (1980). Brannam concluded that none of the twenty selected demographic or personal characteristics were predictors of teacher effectiveness. Based upon these two studies (as well as others conducted in earlier years), it

appears that T&I teacher characteristics variables have little association with student achievement.

An emerging area of concern is the performance of teachers on standardized teacher certification examinations. As use of these examinations spreads, research regarding the factors which affect performance on such instruments will likely become more common. Fernandez (1983) reported that the failure rate for non-degreed vocational teacher candidates taking the Florida Teacher Certification Examination (FTCE) was 51 percent compared to an overall failure rate of 16 percent. Candidates from occupational areas requiring a license were less likely to fail the FTCE than those from unlicensed occupations. Candidates who had participated in an inservice certification program failed less often than those who pursued the standard coursework option. Also, candidates holding a high school diploma failed less often than their counterparts who had completed a GED. Years of occupational experience was not found to be related to performance on the FTCE.

Program Development

One of the more sustained curriculum development movements has been that of competency-based teacher education (CBTE). Since the early 1970's, CBTE has been explored extensively and initiated in many colleges across the country. Serving as a base for much of the CBTE movement was the research conducted by Cotrell, Chase, and Molnar (1972). The 384 vocational teacher competencies identified by this research team eventually led to the development of 100 learning modules that focus on many of the key professional skills needed by vocational teachers.

Cotrell's research stimulated the conduct of numerous statewide studies in various vocational service areas, each of which was intended

to identify those competencies needed for successful teaching (e.g., Andreyka, 1976; Turner, 1979). Although space does not permit a listing of competency studies, reports in this area range from special needs (Farmer, 1979) to reading (Horlivy, 1977). A closely related study by Walker (1978) reported the development and validation of a criterion-referenced test that focuses on selected pedagogical performance elements of a CBTE program. Five development and validation stages were reported. This study pointed out that even though valid instruments can be developed in support of CBTE programs, their development costs may be quite high. Those choosing to implement CBTE in their institutions would do well to explore the various costs associated with high quality programs.

Several studies have the potential to impact on T&I teacher education program change and improvement. One such study conducted by Walker, Merryman, and Staszkiewicz (1984) focused on identifying learning styles that might increase cognitive achievement in a performance-based teacher education program. As a result of their study, diagnostic and prescriptive capabilities of the program have been expanded. Characteristics profiles are prepared as students enter the program and detailed action planning is conducted for each student. A second study (Pucel & Walsh, 1981) identified needed teacher education activities for part-time instructors of adult vocational programs. Based on the results, it was concluded that formal teacher education activities be developed for part-time instructors. The information provided in this study has much value for those who must design new programs for part-time T&I teachers.

Also common are studies of more general concerns about T&I teacher education. Recognizing the need to organize T&I teacher certification processes in a more efficient manner, Lear (1980) designed a management

information system that provides certification status information to four user groups: teacher educators, teachers, state staff, and local education agency directors. The system was developed in concert with the Criteria Acquisition Model for educational product development. Wright and Hess (1974) indicated that such a model assumes there are specific stages in the life of educational products and that specific criteria must be met before a product is advanced to the next stage of development.

T&I teacher education delivery systems across the United States were assessed by Sheppard (1981). He found that T&I teachers were not prepared in a manner similar to general education teachers or other vocational teachers. The researcher also noted that teacher preparation in instructing disadvantaged and handicapped students, as well as in topics dealing with sex sterotyping, is typically not generally required. This lack of emphasis on sex sterotyping may relate in some way to the low numbers of women who teach in traditionally male-intensive vocational education programs. A retraining program to help meet the need for more women in nontraditional teaching roles was described by Kane (1978). Such a program should focus on the T&I and industrial arts areas. Program planning efforts would include heavy emphasis on recruitment, selection, counseling, and use of various support groups.

Teacher Behavior

A most elusive area in teacher education research is the identification of relationships between teacher behavior and student achievement. In fact, most teacher education programs cannot be justified on the basis of contribution to student achievement. Since program administrators cannot justify this contribution, they merely indicate that various content elements are important to success as a teacher. A number of years ago,

Popham (1968) sought to develop performance tests that would distinguish between experienced T&I teachers and persons who had never taught (non-teachers). Comparisons of pupil performance data revealed no systematic differences between the performance of the teacher and non-teacher groups in the areas of either auto mechanics or electronics. Though it would appear that Popham's research on T&I teacher performance tests is a dead issue, this area still has much potential, particularly with the advent of competency-based teacher education.

Several additional studies highlight the potential for sustained effort in studying teacher behavior as it relates to student achievement. McKinney (1979) sought to identify relationships between T&I auto mechanics teacher behavior and the achievement of students in their classes. Teacher behavior was measured by the Vocational Teacher Observation of Process System (VTOPS) and student achievement was assessed via the Ohio T&I Achievement Test. Significant correlations were found between student achievement and two VTOPS measures, variety quantity and variety range. This study reveals the opportunity researchers may have to identify key relationships between teacher behavior and student achievement.

Ongoing efforts at the National Center for Research in Vocational Education may result in meaningful measures of teacher behavior. Halasz and McCaslin (1982) reported the development of procedures to measure vocational teacher time on task (a most crucial factor that affects student learning and achievement). Their findings included a most interesting profile of the productive time spent by vocational teachers in their various classes. More important, however, is the potential that time-on-task assessment has to uncover more meaningful linkages between T&I teacher behavior and student achievement.

The relationship between personality as an indicator of behavior and teacher competency/effectiveness is an area of research which is receiving increasing attention. Although this area of inquiry has potential for explaining many important questions regarding why some T&I teachers are more effective than others, little substantive research is currently available. A study of post-secondary vocational/technical teachers conducted by Beebe (1982) found that students' ratings of the affective competence of teachers was related to the students' ratings of those teachers' effectiveness while traditional variables, such as years of teaching and occupational experience, were not a significant factor in student ratings of effectiveness.

A slightly different research approach by Pong (1982) focused on the relationship between supervisor ratings and teacher personality. It was found that the extrovert-introvert (E-I) dimension of the Myers-Briggs Type Indicator (MBTI) was related to the quality of a teacher's cooperative program as indicated by the rating of the program by the teacher's supervisor. Sormin (1984) approached the same question from a slightly different perspective. The Sixteen Personality Factor Questionnaire (16PF) was used to define the personality characteristics of vocational industrial teachers from Northeast Texas high schools. The personality, tenseness, suspiciousness, and controllness traits were found to be predictors of teaching effectiveness as measured by supervisors' ratings. While the relationship of personality characteristics and traits to teaching effectiveness is an important area for additional exploration, studies are also needed that focus on identifying ways of developing those characteristics found to be predictors of effectiveness. Otherwise, the temp-

tation will be to use personality characteristics to select T&I teachers, a simplistic and unethical approach to a complicated situation.

Professional Development

Since many T&I teachers do not have bachelor's degrees, heavy reliance is placed on continued professional development to upgrade teachers both pedagogically and technically. The notion of professional development goes beyond "Band-Aid" preparation to focus on career-long development processes that may include a range of personal experiences such as internships, technical courses, and seminars. Swanson (1974) noted that vocational teacher education has unfortunately operated more as a delivery system than as a development system.

Increased interest in the development of T&I teachers as professionals has given rise to several studies in the area. The inservice needs of T&I teachers in Colorado were assessed by Hicken (1977). This study apparently built upon the previously mentioned competency studies, with those items ranking higher in importance than in ability to perform constituting the areas of need. Such a study can be of major significance if linked to a professional development system. Otherwise, it is merely a one-shot approach to teacher needs. Sortore's (1982) study of T&I teachers' professional development practices appears to have dealt with this issue. The researcher assessed needs and then applied them to a conceptual inservice training and professional development model. Perhaps this reflects a change in our traditional perceptions, one that may move toward a comprehensive view of professional development systems for T&I teachers.

A related study by Peller (1982) examined the effects of a new teachers' institute on newly employed T&I teachers. Results showed that

(1) participants scored higher net gains on an achievement test than either of two comparison groups, (2) open-minded participants as measured by Rokeach's Dogmatism Scale scored higher on the achievement test than did closed-minded participants, and (3) experienced teachers scored higher net gains on the achievement test than inexperienced teachers. The locus of control of newly employed teachers did not appear to be altered by the institute experience. Studies of this type may eventually provide teacher educators with more efficient and effective ways of delivering professional development courses and workshops.

What Does Research Tell Us?

With so much research being conducted over the years, one receives the initial impression that T&I teacher preparation is grounded in and supported by meaningful inquiry. This is, unfortunately, far from being true. The preceding summary of T&I teacher education research seems at best to provide interesting trends and at least to help shape a future research agenda. This section will focus on such trends while a concluding section deals more specifically with future research efforts in the field.

Those who choose to become T&I teachers tend to present a personal need or challenge for increased responsibility or personal growth and development. Once employed as a teacher, retention is a function of many things, the most important of which are salary and the teaching environment.

Teacher characteristics are, in some cases, associated with other variables. As would be expected, job satisfactoriness can be predicted reasonably well from job satisfaction. By and large, however, personal characteristics variables have little predictive value in relation to sig-

nificant variables in the teaching/learning process. In general, it may be stated that (1) T&I teachers without bachelors' degrees feel less stress than their degreed counterparts, (2) T&I teachers perceive the ideal student much differently from the way general education teachers perceive the ideal student, (3) T&I teachers' attitudes toward handicapped students and individualized instruction can be influenced through constructive experiences in these respective areas, (4) T&I teachers are not as resistant to educational change as common perceptions might lead us to believe, (5) relationships between teachers' personal characteristics (e.g., years of occupational experience) and their occupational competence share little if any common variance, and (6) T&I teacher characteristics are not related to student achievement.

Turning to the program development area, it may be noted that CBTE has helped teacher educators to better communicate what teachers should learn. Likewise, studies focusing on learning styles and part-time instructors provide ideas for reshaping and redirecting existing teacher preparation programs.

Teacher behavior, particularly as related to student achievement, has been largely ignored in relation to its importance. The few studies highlighted in this area suggest that (1) how teachers behave in their classes may affect student achievement, (2) factors such as student time-on-task should be examined to determine their impact on student achievement, and (3) teacher personality has some potential for predicting teaching effectiveness.

Yes, it is indeed unfortunate research has produced so little that can be used to improve T&I teacher preparation programs. Although T&I teacher education research is no longer in an "embryonic state," it's ev-

olution has been painfully slow. The result to date appears as very few significant additions to the body of knowledge in this important area.

Future Research Thrusts

If future T&I teacher education research is to be more valuable than that which has already been conducted, several major changes in direction are necessary. Although these changes are not completely unrelated, they are each dealt with separately in the paragraphs which follow.

Substantive Questions

A critical need exists to identify substantive questions upon which research efforts may be focused. This is not to imply that substantive questions have been ignored in the past but, rather, that future research needs to focus on underlying theoretical frameworks and constructs rather than merely addressing surface issues. As an example, any additional survey research conducted that centers on describing characteristics of T&I teachers such as years of trade experience, age, sex, and so forth would seem to be of little value. Needed is research focusing on characteristics potentially related to effective teaching and those which can be addressed through teacher education programs. Examples of these more relevant characteristics are personality type and characteristics, locus of control, teaching style, philosophical orientation, and so forth. Some research has been conducted in this area, however, much more is needed.

Methods

The vast majority of studies conducted to date have utilized either survey research, ex-post-facto, or descriptive research methods. While these methods have value, they do not provide the in-depth knowledge about the field that will enable significant research questions to be answered. Qualitative research methodologies have been largely ignored and

yet it is those methodologies which seem most appropriate for addressing many of the more important questions regarding T&I teacher education as well as building theoretical frameworks for meaningful research. Policy research is also lacking and thus there is little evidence available to help determine which problems of the profession are functions of personnel and which are functions of policy. Longitudinal and true experimental studies are, likewise, necessary and can be conducted as an integral part of on-going teacher education programs. In the areas of teacher education and student achievement, causal rather than relational methodologies need to be employed with the intent of developing causal models.

Context/Environment

A major problem in assessing the utility of what has been done is that most past research has ignored context or environment. Researchers need to be aware of, describe, and plan to include context variables in their research. Consider the area of supply and demand for T&I teachers. Findings of research conducted during economic downturns may not be generalizable to periods characterized by an expanding economy. Additionally, the heterogeneity of the field makes the context or environment in which a study is conducted of extreme importance. Both intuition and available evidence indicate, for example, that post-secondary programs and instructors are different from their secondary counterparts, that electronics instructors differ from carpentry instructors, and that programs and standards vary from state to state.

Programmatic Research

Future research efforts must be more coordinated and integrative. Many studies conducted in the past are of limited value because they have little or no relationship to other research. Little effort appears to have

been made to begin a coordinated, on-going program of research which allows studies to build from the findings of other studies. It is only through such efforts that major research questions will be ever answered. Teacher education institutions are the natural location for such programmatic research "centers" and, therefore, would be in the best position to provide leadership for establishing such efforts. Since these institutions are also the most likely benefactors of coordinated approaches to research in T&I teacher education, an investment of this type is certainly warranted.

Conclusion

If T&I teacher education research is to reach beyond the notion seeking simplistic solutions to complex problems, researchers must deal with underlying issues rather than mere symptoms and build a body of knowledge that is both useful and generalizable. Frameworks for research must be established based upon inquiry conducted in other disciplines such as sociology and psychology. Diverse and sophisticated methodologies and statistical treatments must be used in creative, but appropriate, ways. The diversity of T&I teacher education must not only be recognized but investigated. And, programmatic research thrusts must be begun.

Research in T&I teacher education has often been keyed to traditional questions. Take, for example, the often raised question of whether occupational experience (competence) is more important than pedogogy to effective T&I teaching. This question has remained unanswered for almost three quarters of a century and it is unlikely that such a question will ever be answered without including qualifiers describing conditions, environments, and other special circumstances. Rather than maintaining pursuit of the question we instead need to research and identify various

significant qualifiers actually exist. Some promising beginnings in this area can be found but they are rare. Without such research, T&I teacher education will probably continue to be governed by intuition and bias rather than empirical knowledge and philosophy.

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